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明 細 書

1. 発明の名称

光透過量可変性織物

2. 特許請求の範囲

1. 吸湿性を具にする2種以上の合成繊維をサイド・バイ・サイドに複合させ、摺擦を付与して得たノントルクの撚結を有し、かつ、乾燥撚率と吸湿撚率との差が吸湿撚率より30%以上大である撚結撚合繊維と、乾燥による伸長の变化の小さな非撚結繊維とを交差させた織物であつて、該織物の少なくとも片面側のウエルおよびコース、又はそのいずれか一方が、適宜間隔毎に前記非撚結繊維からなる縞目のみにより形成されており、縞割時の織物の寸法変化率が3.0%以下であることを特徴とする光透過量可変性織物。

2. 撚結撚合繊維が5-ナトリウムスルホイソフタル酸を共重合させた変性ポリエチレンテレフタレートと、ナイロン6とからなる撚合繊維である特許請求の範囲第1項記載の織物。

3. 発明の詳細な説明

(産業上の利用分野)

本発明は、光透過量可変性織物に関する。

(従来技術)

従来から、木綿、羊毛等の天然繊維が、湿度変化によって可逆的に撚率が変わることが知られている。

しかしながら、この撚率の変化は、ごく僅かであつて、この変化を認識できるのは、繊維集合体としては布面、袷等の断絶、防寒衣類などの中入部のように撚率差の比較的小さいものに限られていた。

木綿は吸水すると膨潤し、布面の見掛けのカバ-ファクターを増加させる。高密度に編成された撚結織物は吸水して縞目のカバ-ファクターを大とし、乾燥して通気性を増加させる。しかし、このような性質を有する撚結織物も光の透過度を可逆的に変化させるような大きな変化は無い。

一方、合成繊維では、特開第55-93860号公報に記載されているように、アクリル系の合成繊維

を紡織に用いて乾燥させることにより可逆的に溶縮率を変化させることが知られている。この場合も、紡織として用いたものであって、光の透過量を機械的に変化させ得る構造の織物として用いたものではない。

(発明の目的)

本発明の目的は、乾燥時に可逆的に溶縮率を変化し得る感湿膨縮複合繊維を用いて得られる新穎な光透過調節可能な織物を提案することにある。

(発明の構成)

本発明は、吸湿性を具にする2種以上の合成繊維をサイド・バイ・サイドに複合させ、溶縮を付与して得たノントルクの紡縮を有し、かつ、乾燥溶縮率と吸湿溶縮率との差が該乾燥溶縮率より30%以上大である感湿膨縮複合繊維と、乾燥による系の収縮の小さな非感湿繊維とを交錯させた織物であって、該織物の少なくとも片面側のウェールおよびコース、又はそのいずれか一方は、適宜隣接的に前記非感湿繊維からなる編目のみにより形成されており、乾燥時の織物の寸法変化率が

3.0%以下であることを特徴とする光透過調節可能な織物にある。

本発明に使用する感湿膨縮複合繊維は、吸湿性の異なる2種以上の合成繊維をサイド・バイ・サイドに複合させたものであって、特定のポリアミド型とポリエステル成分をサイド・バイ・サイド型に複合紡糸することにより得られるものが好ましく例示される。

特に、ポリアミド成分として、ナイロン6(換算粘度 $[\eta]$ (30℃の η -クレゾール溶液で測定)が1.0~1.4のもの)が好適に使用され、ポリエステル成分として、5-ナトリウムスルホイソフタル酸を共重合させた変性ポリエステルが例示され、5-ナトリウムスルホイソフタル酸の共重合率が15モル%以下のものが使用される。5-ナトリウムスルホイソフタル酸の共重合率は、特に1~7モル%であることが好ましい。市販原料成分には必要に応じて染料、着色剤、帯電防止剤、無定形剤等を添加することができる。

本発明で用いる感湿膨縮複合繊維は乾燥溶縮率

と吸湿溶縮率との差が、該乾燥溶縮率より30%以上大であることが必要である。尚、本発明において、乾燥率(TC)は下記により測定する。

乾燥率(TC)

図解複合繊維糸系を長さ30cmの塩とり、2 μ m/40の荷重をかけて沸水中に20分間浸漬し、次いで24時間自然乾燥した後、200 μ m/40の荷重をかけ、1分放置後の長さを測定してその長さを l_1 とし、その後2 μ m/40の荷重下で1分放置後の長さを測定してその長さを l_2 とし、次式により溶縮率(TC)を算出する。

$$TC = \frac{l_2 - l_1}{l_1} \times 100 (\%)$$

尚、実施例において、感湿膨縮率という場合は30℃、相対湿度90%の雰囲気下に2時間放置した後、上記方法によって測定した溶縮率を意味し、また、乾燥膨縮率という場合は、恒湿乾燥器で湿度60℃、30分間乾燥した後、上記方法によって測定した溶縮率を意味する。

乾燥の溶縮率の差が吸湿膨縮率の30%未満であると、感湿膨縮複合繊維の形態変化が少なく、本

発明の目的を達成することが出来ない。

又、該感湿膨縮複合繊維はノン・トルク紡縮を有しているものである。ノン・トルク紡縮は、紡糸、延伸処理後の該複合繊維を加熱変形伸込ノズルにより処理して得られる。このような方法により得られる紡縮の形態は、糸を構成する繊維間の紡縮の形態(ピッチ、歪み)の差が少なく、繊維間の交絡が少く、かつ戻れがないためトルクが生じない。これらの点は、仮加工糸と大きく異なる。

次に、本発明に使用する非感湿繊維とは、乾燥状態のものと、吸湿雰囲気中に放置した状態のものとの間に実質的に糸長差を生じないものであって、合成繊維100%の長繊維連続糸、仮加工糸、紡縮糸や、天然繊維との混紡糸、又は天然繊維100%の紡縮糸などが例示される。

本発明の織物は、前記の感湿膨縮複合繊維と、非感湿繊維とを交錯して得られる。織成に際しては、該織地のウェールおよびコース、又は、そのいずれか一方が、適宜隣接的に、該非感湿繊維が

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らなる編目のみにより形成される必要がある。

図面により編成法を説明する。

第1図～第3図は、本発明の編物に使用し得る組織の例を示す組織図である。図において、 C_1 、 C_2 、… C_n の列は、シリンドラー針で編成される編目(×印で示す)であり、 D_1 、 D_2 、 D_3 、… D_n の列はダイヤル針で編成される編目(○印で示す)である。又、右側の数字は、系の種類を示し、1は、感湿繊維複合繊維からなる系を、2は非感湿繊維からなる系を示す。第1図において、シリンドラー針 C_1 、… C_4 では、非感湿繊維の系2により編目を感成し、 C_5 、… C_8 は針抜きとなっているため、シリンドラー針編目側は、この部で非感湿繊維系のみでウェールが形成されている。又、左側の文字、a、b、c…の行は、編地のコースを示す。第1図の場合は、i、j、…、kの行の編目であって、ダイヤル針で編成されるもの(○印のもの)は、非感湿繊維系2により編成されている。したがって、シリンドラー針編目側では、 C_1 、…、 C_4 の列で示すウェールと、ダイ

ヤル針編目側では、i、j、…、kの行で示すコースとは、共に非感湿繊維系2のみからなる編目により編成されていて、シリンドラー針編目、ダイヤル針編目からなるとはいえ、ウェール方向と、コース方向の格子状の骨格部分を形成している。

第2図の例では、同様にして、 C_1 、 C_2 、… C_4 のシリンドラー針編目によるウェールと、ダイヤル針編目によるe、f、…、hのコースとが非感湿繊維系2とにより編成され、同様の骨格部分を形成する。

第3図の例では、 C_5 、 C_6 、… C_8 のシリンドラー針編目によるウェールとkの行のコース、およびe、f、…、hの行のダイヤル針編目によるコースとが、非感湿繊維系2により編成され、骨格部分を形成する。

但し、本発明の編物は、前記第1図～第3図の例に限定されるものではない。

このようにして編成された編物は、試料として25cm×25cmの布片を用意し、経方向、緯方向の20cm×20cmのところに目印を付け、目印部分の乾

縮時、及び吸湿時の縮布片の寸法から、収縮時の寸法変化率を下記により求める。

$$\text{寸法変化率}(\%) = \frac{|L_w - L_d|}{L_d} \times 100(\%)$$

L_d : 湿度60%の恒湿乾燥箱中に30分間放置した後の縮物の経方向、又は、緯方向の寸法(cm)

L_w : 湿度30%、相对湿度90%の雰囲気下に2時間放置した後の縮物の経方向、緯方向の寸法(cm)

かくして求められる寸法変化率(%)が、経方向、緯方向共に3.0%以下である必要がある。

(発明の作用)

本発明の編物は、以上のような構成を有するため、吸湿、又は吸水して、編物構造が、乾燥時には変化する。

即ち、吸湿、吸水時には、編物を構成する糸間に空隙が生じ、透気量が変化し、光の透過量が増加し、又、乾燥時には光の透過量が減少する。しかも、これらの変化は可逆的に応ずる。

吸湿、吸水の際には、感湿繊維複合繊維の捲

縮の減少に起因して糸の見掛け直径が減少し、糸間の空隙が増大する。

又、感湿繊維の減少に伴って糸が伸長し、編目の密度を、ハシ、糸間に立体的な空隙を発生させる。

又、吸湿、吸水時には編物表面の凹凸の発生や、凹凸が既にあるものでは、それが強調される、感湿繊維複合繊維と、非感湿繊維とが異相である場合は、凹凸凸効果と相俟って、色彩効果の変化も得ることが出来る。

かかる編物は、インテリア用途、農業用途等に使用されるのは勿論、その編物構造変化に起因する透気性の変化などは、従来のない機能を編物に付与するものであって、運動発汗時の衣類内気候の温度調節に有効に作用するため、広くスポーツ用衣類や、夏季用衣類の素材としても有効である。(実施例)

極限粘度[η]が1.0(30℃のN-クレゾール溶液で測定)のナイロン6と極限粘度[η]が0.4(25℃のo-クロロフェノール溶液で測定)であり、2.5モル%の5-ナトリウムスルホン

フタル酸を共重合させた変性ポリエチレンテレフタレートとを常法により、粘糸温度 280℃、両成分の重合比 1:1 (重量比) でサイド・バイ・サイド型の粘糸口金 (48孔) を用いて粘速 500mm/分で被合粘糸し、引き結き、選検して 80℃ の温度で 3.5倍に延伸し、無張状態で 130℃ の温度で熱処理した後、連続して温度 190℃ の加熱媒体移送ノズルを通して溶融接合加工を施し、接合加工糸として巻き取った。

本実施例では、加工後のデニールが約 1500d になるように吐出量を調節した。このようにして得られた繊維接合繊維の乾燥収縮率は 22.2%、吸湿収縮率は 8.4% であった。

この繊維接合繊維と通常のポリエステル被合加工糸 (1500d/48fil, 乾燥時収縮率 25.0%) を用い、第 2 図に示す組織、糸の配列により編成し、預織→染色→ファイナルセットを基本とする染色仕上工程により仕上げた。得られた織物の外観・性能を第 1 表に示す。

比較用として、繊維接合繊維を用い、織

組織として第 2 図に示すものを用い、(但し、糸の配列のみ無視して、1、2 の糸は共に繊維接合繊維のみを用いる) 実施例と同様にして織物を得た。得られた織物の外観、性能を第 1 表に合せて示す。

又、他の比較用として、前記被合加工糸を用い、繊維組織として第 2 図に示すものを用い(但し、糸の配列のみ無視して 1、2 の糸は共に被合加工糸のみを用いる)、実施例と同様にして織物を得た。得られた織物の外観・性能を第 1 表に合せて示す。

(以下空白)

第 1 表

	No.	1	2	3
		実 形 片 袋 編 (第 2 図)	同 左	同 左
織 造	糸 使 い	(1) の糸として、被合糸 (1500d/48fil) (2) の糸として、ポリ エステル被合糸 (1500d/48fil)	(1), (2) の糸は共に 被合糸 (1500d/48fil) 100% 使い	(1), (2) の糸は共に ポリエステル被合 糸 (1500d/48fil) 100% 使い
	仕上条件 opt wpi	36 30	36 30	35 30
織 造 時 の 変 化	外 観	被合糸の部分が浮き上り、凹凸を生じる	凹凸は小さくなる	凹凸変化ほとんどなし
	光の透過率 (%)			
	乾 燥	3 12	2 18	4 6
	編造時の寸法 変化率 (%)			
	タテ	1.5	8.0	9
	ヨコ	2.3	13.2	1.2
		実 施 例	比 較 例	比 較 例

但し、表中被合糸は繊維接合繊維を、ポリエステル被合糸は非繊維組織を示す。

造、光の透過率の測定は下記による。

光の透過率

試料を写真引伸機のフィルム挿入部に入れ 8 倍に拡大して印面紙に焼き付ける (光の透過部は黒く焼き付けられる)。この焼き付けられた印面紙を直径 27mm の色差計でしじを求める。

光の透過率は、下記式により求める。

$$\text{光の透過率 (\%)} = \left(1 - \frac{L_w - L_b}{L_w - L_g}\right) \times 100$$

ここに、

L_w : 織物をフィルム挿入部に入れ、上記の方法で求めたしじ値 (編造時、乾燥時の織物について求める)。編造時の織物とは、水に 30 分間浸漬後、水を軽く洗い取り、この状態の織物で測定する。

L_w : 織フィルム挿入部に黒色の厚紙を入れ、同様の方法で求めたしじ値。

L_b : フィルム挿入部には何もしないで、同様の方法で求めたしじ値。

第 1 表で明らかにように、繊維接合繊維を用いていても、No. 2 のような編成法では、寸法

変化率が大であり、3.0%以下を満足しない。又、N0.3の系統のものでは、光の透過量の変化が少なく、本発明の顕像が得られない。

4. 図面の簡単な説明

第1図～第3図は、本発明の顕像に使用し得る四方の例を示す組織図である。

- 1…縦横複合組織組織
- 2…非縦横組織

才 1 図

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₃₅₁	C ₃₅₂	C ₃₅₃	C ₃₅₄	C ₃₅₅	C ₃₅₆	C ₃₅₇	C ₃₅₈	C ₃₅₉	C ₃₆₀	C ₃₆₁	C ₃₆₂	C ₃₆₃	C ₃₆₄	C ₃₆₅	C ₃₆₆	C ₃₆₇	C ₃₆₈	C ₃₆₉	C ₃₇₀	C ₃₇₁	C ₃₇₂	C ₃₇₃	C ₃₇₄	C ₃₇₅	C ₃₇₆	C ₃₇₇	C ₃₇₈	C ₃₇₉	C ₃₈₀	C ₃₈₁	C ₃₈₂	C ₃₈₃	C ₃₈₄	C ₃₈₅	C ₃₈₆	C ₃₈₇	C ₃₈₈	C ₃₈₉	C ₃₉₀	C ₃₉₁	C ₃₉₂	C ₃₉₃	C ₃₉₄	C ₃₉₅	C ₃₉₆	C ₃₉₇	C ₃₉₈	C ₃₉₉	C ₄₀₀	C ₄₀₁	C ₄₀₂	C ₄₀₃	C ₄₀₄	C ₄₀₅	C ₄₀₆	C ₄₀₇	C ₄₀₈	C ₄₀₉	C ₄₁₀	C ₄₁₁	C ₄₁₂	C ₄₁₃	C ₄₁₄	C ₄₁₅	C ₄₁₆	C ₄₁₇	C ₄₁₈	C ₄₁₉	C ₄₂₀	C ₄₂₁	C ₄₂₂	C ₄₂₃	C ₄₂₄	C ₄₂₅	C ₄₂₆	C ₄₂₇	C ₄₂₈	C ₄₂₉	C ₄₃₀	C ₄₃₁	C ₄₃₂	C ₄₃₃	C ₄₃₄	C ₄₃₅	C ₄₃₆	C ₄₃₇	C ₄₃₈	C ₄₃₉	C ₄₄₀	C ₄₄₁	C ₄₄₂	C ₄₄₃	C ₄₄₄	C ₄₄₅	C ₄₄₆	C ₄₄₇	C ₄₄₈	C ₄₄₉	C ₄₅₀	C ₄₅₁	C ₄₅₂	C ₄₅₃	C ₄₅₄	C ₄₅₅	C ₄₅₆	C ₄₅₇	C ₄₅₈	C ₄₅₉	C ₄₆₀	C ₄₆₁	C ₄₆₂	C ₄₆₃	C ₄₆₄	C ₄₆₅	C ₄₆₆	C ₄₆₇	C ₄₆₈	C ₄₆₉	C ₄₇₀	C ₄₇₁	C ₄₇₂	C ₄₇₃	C ₄₇₄	C ₄₇₅	C ₄₇₆	C ₄₇₇	C ₄₇₈	C ₄₇₉	C ₄₈₀	C ₄₈₁	C ₄₈₂	C ₄₈₃	C ₄₈₄	C ₄₈₅	C ₄₈₆	C ₄₈₇	C ₄₈₈	C ₄₈₉	C ₄₉₀	C ₄₉₁	C ₄₉₂	C ₄₉₃	C ₄₉₄	C ₄₉₅	C ₄₉₆	C ₄₉₇	C ₄₉₈	C ₄₉₉	C ₅₀₀	C ₅₀₁	C ₅₀₂	C ₅₀₃	C ₅₀₄	C ₅₀₅	C ₅₀₆	C ₅₀₇	C ₅₀₈	C ₅₀₉	C ₅₁₀	C ₅₁₁	C ₅₁₂	C ₅₁₃	C ₅₁₄	C ₅₁₅	C ₅₁₆	C 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(54) TITLE OF THE INVENTION: KNITTED GOODS CHARACTERIZED BY
VARIABLE AMOUNT OF LIGHT TRANSMISSION

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SPECIFICATION

1. TITLE OF THE INVENTION

KNITTED GOODS CHARACTERIZED BY VARIABLE AMOUNT OF LIGHT TRANSMISSION

2. WHAT IS CLAIMED IS:

(1) Knitted goods characterized by variable amount of light transmission formed by cross-knitting:

the moisture responsive crimped composite fiber containing a non-torque crimp obtained by forming a crimp through side-by-side compounding of two or more synthetic fibers having different moisture absorbencies, wherein the difference between the dry crimping rate and wet crimping rate is greater than the aforementioned wet crimping rate by 30 % or more; and

the non-moisture responsive fiber less subjected to a change in length between the states of being dry and wet;

wherein the wale and/or course on at least one side of said knitted goods is formed of the stitch made up of only said non-moisture responsive fiber at appropriate intervals, and the dimensional change rate in the wet state does not exceed 3.0 %.

(2) The knitted goods described in Claim 1 wherein said moisture responsive crimped composite fiber is a composite fiber made up of the denatured polyethylene terephthalate formed by copolymerization of 5-sodium sulfoisophthalic acid, and nylon 6.

3. DETAILED DESCRIPTION OF THE INVENTION

(INDUSTRIAL FIELD OF APPLICATION)

The present invention relates to knitted goods characterized by variable amount of light transmission.

(PRIOR ART)

A natural fiber such as cotton and wool has been known to have its crimping rate reversibly changed by a change in humidity.

However, the change in crimping rate has been so small that it can be identified only in the fiber aggregate characterized by smaller inter-fiber restriction as exemplified by bat wool such as bedding and pillow, and cotton wadding such as cold weather protection clothing.

The cotton swells by absorbing moisture and causes an increase in the apparent cover factor of the fabric. The cotton goods knitted to a high density absorb moisture to increase the cover factor of the stitch and are dried to increase air-permeability. However, the knitted goods of cotton having the aforementioned properties are not capable of such a big change as reversible change in the amount of the light transmission.

In the meantime, it is known that reversible change in crimping rate of the synthetic fiber can be achieved by using an acrylic synthetic fiber as a bat wool and by drying it, as disclosed in the Unexamined Japanese Patent Application Publication No. 55-93860 (Tokkaisho). In this case, this fiber is used as a bat wool, not used as the knitted goods having a structure capable of causing positive change in the amount of light transmission.

(OBJECT OF THE INVENTION)

The object of the present invention is to provide new knitted goods characterized by variable amount of light transmission obtained by using the moisture responsive crimped composite fiber capable of causing a reversible change in the crimping rate between the states of being wet and dry.

(Construction of the Invention)

The present invention provides knitted goods characterized by variable amount of light transmission formed by cross-knitting the moisture responsive crimped composite fiber containing a non-torque crimp obtained by forming a crimp through side-by-side compounding of two or more synthetic fibers having different moisture absorbencies, wherein the difference between the dry crimping rate and wet crimping rate is greater than the aforementioned wet crimping rate by 30 % or more; and the non-moisture responsive fiber less subjected to a change in length between the states of being dry and wet; wherein the wale and/or course on at least one side of said knitted goods is formed of the stitch made up of only said non-moisture responsive fibers at appropriate intervals, and the dimensional change rate in the wet state does not exceed 3.0 %.

The moisture responsive crimped composite fiber used in the present invention is formed by side-by-side compounding of two or more synthetic fibers having different moisture absorbencies, and is preferably exemplified by the one having been formed by side-by-side composite spinning of a specific polyamide component and polyester component.

In particular, nylon 6 (having a limiting viscosity $[\eta]$ of 1.0 through 1.4 when measured by an m-cresol solution at 30 °C) is preferably used as the polyamide component. The denatured polyester formed by copolymerization of 5-sodium sulfoisophthalic acid is given as an example of the polyester component, and the one without the amount of copolymerization of 5-sodium sulfoisophthalic acid exceeding 15 mol % is employed. The amount of copolymerization of 5-sodium sulfoisophthalic acid is preferably 1 through 7 mol % in particular. If required, a matting agent, coloring agent, antistatic agent and heat stabilizing agent can be added to both components.

The moisture responsive crimped composite fiber used in the present invention is required to have the difference between the dry and wet crimping rates which is greater than the aforementioned wet crimping rate by 30 % or more. It should be noted that, in the present invention, the crimping rate (TC) is measured according to the following procedure:

Crimping Rate (TC)

A crimped composite fiber thread strip is placed on a skeining device having a length of 30 cm, and is dipped in boiling water with a load of 2 mg/de applied thereto. After

having been subjected to natural drying for 24 hours, the strip is placed under a load of 200 mg/de, and is left to stand for one minute. After that, the length is measured, and the measurement is assumed as ℓ_1 . Then the strip is left to stand under a load of 2 mg/de for one minute, and the length is measured. The measurement is assumed as ℓ_2 . Thus, the crimping rate is measured according to the following formula:

$$TC \times \frac{\ell_1 - \ell_2}{\ell_1} \times 100 (\%)$$

In the embodiment, the wet crimping rate denotes the crimping rate measured according to the aforementioned procedure after the test object has been left to stand for two hours at 30 °C with a relative humidity of 90 % RH. The dry crimping rate denotes the crimping rate measured according to the aforementioned procedure after the test object has been dried in a constant-temperature dryer for 30 minutes at 60 °C.

If the difference between the dry and wet crimping rates is below 30 %, the moisture responsive crimped composite fiber is less subjected to a change in shape, and the object of the present invention cannot be achieved.

Further, the moisture responsive crimped composite fiber contains a non-torque crimp. The non-torque crimp is obtained by processing the spun and drawn composite fiber by a heated fluid push-in nozzle. The form of the crimp obtained in this procedure is characterized in that there is little difference in the form (pitch and amplitude) of the crimp among the short fibers constituting the yarn. Further, there is little confounding of the short fiber without runout, with the result that torque does not occur. These properties are much different from those of the false-twisted textured yarn.

The non-moisture responsive fiber used in the present invention is characterized in that there is substantially no difference in yarn length between the fiber under dry conditions and that having been left to stand under wet conditions. This fiber is exemplified by a long continuous fiber made up of 100 % synthetic fiber, false twisted textured yarn, spun yarn, mixed yarn with natural fiber, or spun yarn made up of 100 % natural fiber.

Knitted goods of the present invention are obtained by cross-knitting of the aforementioned moisture responsive crimped composite fiber and non-moisture responsive fiber. At the time of knitting, the wale and/or course of the

knitting fabric must be formed of the stitch made up of only said non-moisture responsive fiber at appropriate intervals.

The following describes the knitting procedure with reference to drawings:

Figs. 1 through 3 are the texture charts representing the examples of the textures that can be used in the knitted goods of the present invention. In these drawings, the column of $C_1, C_2, \dots C_n$ denotes the stitch (indicated by "x") knitted by the cylinder needle. The column of $D_1, D_2, D_3, \dots D_n$ denotes the stitch (indicated by "O") knitted by the dial needle. The numeral on the right indicates the type of the yarn. "1" indicates the yarn formed of the moisture responsive crimped composite fiber. "2" indicates the yarn formed of non-moisture responsive fiber. In Fig. 1, the stitch is knitted by the cylinder needles $C_1, \dots C_4$ using the yarn 2 of non-moisture responsive fiber, and a broad stitch is formed by the cylinder needles $C_5, \dots C_8$. The wale of the non-moisture responsive fiber alone is formed on the side of the cylinder needle stitch. Further, the row of letters a, b, c, ... on the left indicates the course of the knitting fabric. Fig. 1 shows the stitch of the row of i, j, ... l. The one knitted by the dial needle (marked by a

circle) uses the non-moisture responsive fiber 2. Accordingly, the wale indicated by the column of $C_1, \dots C_4$ on the side of the cylinder needle stitch and the course indicated by the row of $i, j, \dots \ell$ on the side of the dial needle stitch are knitted by the stitch formed of only the non-moisture responsive fiber 2. Although they are produced by the cylinder needle stitch and dial needle stitch, they forms a grid-like skeleton in the directions of wale and course.

Similarly, in the example of Fig. 2, the wale by the cylinder needle stitch of $C_1, C_2, \dots C_4$ and the course of $e, f, \dots h$ by the dial needle stitch are knitted by the non-moisture responsive fiber 2, whereby the similar skeleton is formed.

In the example of Fig. 3, the wale by the cylinder needle stitch of $C_5, C_6, \dots C_8$, the course of row of l and the course by the dial needle stitch on the row of $e, f, \dots h$ are knitted by the non-moisture responsive fiber 2, whereby the similar skeleton is formed.

It should be noted, however, that the knitted goods of the present invention are not restricted to the examples of the aforementioned Figs. 1 through 3.

A 25 cm x 25 cm piece of cloth is prepared as a sample of the knitted goods knitted in this way, and a mark is applied to the position of 20 cm x 20 cm in longitudinal and lateral directions. The dimensional change rate in the wet state is calculated as follows, using the dimensions of the cloth when the marked position is dry as well as when it is wet:

$$\text{Dimensional change rate (\%)} = \frac{|L_w - L_d|}{L_d} \times 100 (\%),$$

wherein L_d denotes the dimension in the longitudinal or lateral direction when the sample has been left to stand in a constant-temperature dryer at a relative humidity of 60 percent for 30 minutes, and L_w indicates the dimension in the longitudinal or lateral direction when the sample has been left to stand in an environment of 30 °C with a relative humidity of 90 percent for two hours.

The dimensional change rate (%) obtained by the aforementioned procedure must not exceed 3.0 % in either the longitudinal or lateral direction.

(OPERATION OF THE INVENTION)

The knitted goods of the present invention are structured as described above, and therefore, the structure

of the knitted goods undergoes a change by absorbing moisture or water.

To be more specific, when moisture or water is absorbed, spaces are formed among the yarns constituting the knitted goods. This causes the amount of gas transmission to be changed. Thus, the amount of light transmission is increased, or is reduced when dry. Moreover, this change occurs in reversible manner.

When moisture or water is absorbed, the apparent diameter of the yarn is reduced by a decrease in the crimp of the aforementioned moisture responsive crimped composite fiber, with the result that spaces among yarns are increased.

The yarn is elongated with the decrease in the crimp, the density of the stitch is changed and three-dimensional spaces are produced between the "hashi???" and yarn.

When moisture or water is absorbed, a concave-convex structure is produced on the surface of the knitted goods, or is intensified if there is any. When the moisture responsive crimped composite fiber and non-moisture responsive fiber are dyed differently, a change in the coloring effect can be achieved under the influence of the effect of the aforementioned concave-convex structure as well.

Such a woven fabric is preferably used for interiors and agricultural purposes, as well as for sports wears and summer wears, because a change in air-permeability resulting from change in the structure of the knitted goods provides the knitted goods with the excellent function that has never been found in the conventional products. This function is effectively used to adjust the humidity inside the clothes when sweating at the time of physical training.

(Embodiment)

The nylon 6 having a limiting viscosity $[\eta]$ of 1.0 (when measured by an m-cresol solution at 30 °C) and the denatured polyethylene terephthalate having a limiting viscosity $[\eta]$ of 0.4 (when measured by an o-chlorophenol solution at 25 °C) and formed by copolymerization of 2.6 mol % 5-sodium sulfoisophthalic acid were subjected to compounding and spinning by the normal method at a spinning temperature of 280 °C at a spinning speed of 500 meters per minute using a side-by-side type spinning nozzle (48 orifices), wherein the compounding ratio of both components is 1 to 1 (in terms of specific weight). This material was drawn by 3.5 times on a continual basis at a temperature of 80 °C and was subjected to heat treatment in a tightened

state at 130 °C. After that, this material was put through a heated fluid push-in nozzle on a continual basis at a temperature of 190 °C, wherein crimp development processing was carried out. This was wound up as a crimped textured yarn.

In this embodiment, the discharge rate was adjusted so as to get about 150 deniers subsequent to processing. The dry crimping rate of the moisture responsive crimped composite fiber obtained in the aforementioned procedure was 22.2 % and the wet crimping rate was 8.4 %.

This moisture responsive crimped composite fiber and conventional polyester false twisted textured yarn (150 de/48 fil, with a dry crimping rate of 25.0 %) were knitted according to the knitting texture and yarn arrangement of Fig. 2. This material was finished by the dyeing finishing process basically consisting of a processing sequence of scouring, dyeing and final setting. Table 1 shows the external view and performances of the knitted goods produced in this manner.

For the sake of comparison, knitted goods were produced using the aforementioned moisture responsive crimped composite fiber in the same procedure as the embodiment,

wherein the knitting texture used is shown in Fig. 2 (wherein only the yarn arrangement is ignored, and only the moisture responsive crimped composite fiber is used for yarns 1 and 2). Table 1 also shows the external view and performances of the knitted goods produced in this manner.

To provide another comparative example, knitted goods were produced using the aforementioned false twisted textured yarn in the same procedure as the embodiment, wherein the knitting texture used is shown in Fig. 2 (wherein only the yarn arrangement is ignored, and only the false twisted textured yarn is used for both yarns 1 and 2). Table 1 also shows the external view and performances of the knitted goods produced in this manner.

Table 1

	No.	1	2	3
Knitting specification	Knitting texture	Deformed single bag knitting (Fig. 2)	Same as the left	Same as the left
	Yarn arrangement	Bicomponent filament yarn (150 de/48 fil) as a yarn (1) Polyester false twisted yarn (150 de/48 fil) as a yarn (2)	Bicomponent filament yarn (150 de/48 fil) as both the yarns (1) and (2) 100 % used	Polyester false twisted yarns (150 de/48 fil) as both the yarns (1) and (2) 100 % used
	Finished density cpi wpi	36 30	36 30	35 30
Change in the wet state	External appearance	A concave-convex structure is produced by uplifting of the bicomponent filament yarn.	The concave-convex structure is reduced.	Almost no change in concave-convex structure
	Light transmission rate (%)			
	Dry	3	2	4
	Wet	12	18	6
	Change rate in dimensions when wet (%)			
	Longitudinal	1.5	8.0	0
	Lateral	2.3	13.2	1.2
		Embodiment	Comparative example	Comparative example

In Table 1, the bicomponent filament yarn denotes the moisture responsive crimped composite fiber and the polyester false twisted yarn indicates the non-moisture responsive fiber.

The following procedure was used to measure the light transmission.

Light Transmission

A sample was put into the film inlet of the photoenlarger, was enlarged eight times and was printed on photographic paper (wherein the portion subject to light transmission was printed in black). The printed photographic paper was measured by color-difference meter having a diameter of 27 mm to get the value L.

The following formula was used to get the light transmission rate:

$$\text{Light transmission rate (\%)} = \left(1 - \frac{L_t - L_b}{L_w - L_b} \right) \times 100,$$

wherein

L_t : Value L obtained in the aforementioned procedure (obtained for both the wet and dry states) after the sample has been put into the film inlet, wherein the value for the wet sample is obtained by measurement after dipping the sample in water for 30 minutes and sucking water gently thereafter.

L_w : Value L obtained in the same procedure by inserting black thick paper into the aforementioned film inlet.

L_b : Value L obtained in the same procedure without inserting any thing in the inlet.

As will be apparent from Table 1, in the knitting procedure No. 2, the change rate in dimensions is too large,

even when the moisture responsive crimped composite fiber is used. This will result in a failure to meet the requirement of not exceeding 3.0 %. In the case of the yarn No. 3, a change in the amount of light transmission is too small to get the knitted goods of the present invention.

4. BRIEF DESCRIPTION OF THE DRAWINGS

Figs. 1 through 3 are drawings showing the texture that can be used in the knitted goods of the present invention.

- 1 Moisture responsive crimped composite fiber
- 2..... Non-moisture responsive fiber

Fig. 1

Fig. 2

Fig. 3